The Safe Use of Pressurized Flammable Liquid Dispensing Systems

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Battelle

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Disclaimer

of this presentation, any comment as to the any part of any NFPA code or standard is only the opinion of the presenter and is NOT to be relied upon as either accurate or official. Only the NFPA may issue a formal interpretation of its codes and standards.

This presentation is not on behalf of any vendors or their products.

- Understand what a Pressurized Liquid Dispensing Container (PLDC) is
- Testing that has been performed on PLDCs
- How are PLDCs addressed by codes
- Recommendations for use in laboratory spaces

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- Stainless steel containers with a capacity of up to 227 liters
- Burst pressure tested between 200 to 1000 psi
- Meet DOT UN 1A1 regulations and some are ASME pressure vessels
- Pressure relief in accordance with NFPA 30

FisherPak Solvent Delivery System

PLDC?

- Reusable container – no waste
- Maintain high purity of solvents
- No contamination of solvent during dispensing
- Safer to use then glass bottles
- Closed system for dispensing
- FM approved dispensing system

s - FisherPak


FM
APPROVED


REMOVE YELLOW
CAP BEFORE CONNECTING
ANYTHING TO DRUM
FISHER.

oval Guide, Section 6-8, *Flammable Liquid Equipment*

DISPENSING SYSTEMS

e designed to provide for the safe transportation and
mable liquids, primarily high purity solvents. They consist
ainer equipped with a pressure relief valve; self-closing dispensing, filling, and pressurization ports (typically quick disconnect type); a pressure regulator; and a liquid level indicator (optional). Containers must comply with DOT 49CFR Subpart M and/or UN 1A1W requirements for transportation of hazardous materials. Drop tests must be conducted with all available fittings and attachments installed on the container. Dispensing pressure regulator output must be limited to the pressure rating of the container. Relief valve venting capacity must equal or exceed that determined by the heat absorption and vapor generation formulas specified in NFPA 30.

VENDORS WITH APPROVED SYSTEMS

- **EM Science, 2909 Highland Ave, Cincinnati OH 45212**
- **Fisher Scientific, One Reagent Ln, Fair Lawn NJ 07410**
- **Honeywell Burdick & Jackson Inc, 1953 S Harvey St, Muskegon MI 49442**
- **Mallinckrodt Baker Inc, 600 N Broad St, Phillipsburg NJ 08865**

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- n testing of an FM approved system?
- NFPA 45 committee concerns
  - No evidence that PLDCs would be safe for use in labs without fire separation barriers
  - Quantity of largest containers exceeded amounts allowed outside of cabinets/rooms
- Goal of testing was to evaluate structural integrity of containers, to evaluate the performance of pressure relief devices (PRDs), and to assess impact of fire sprinkler system on vented container

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- nged by The NFPA Fire Protection Research Foundation
- Funded by manufacturers and users
- Performed at Southwest Research Institute March – April 2003
- Pressurized Liquid Dispensing Containers Research Project – Final Report published by The NFPA Fire Protection Research Foundation November 2003

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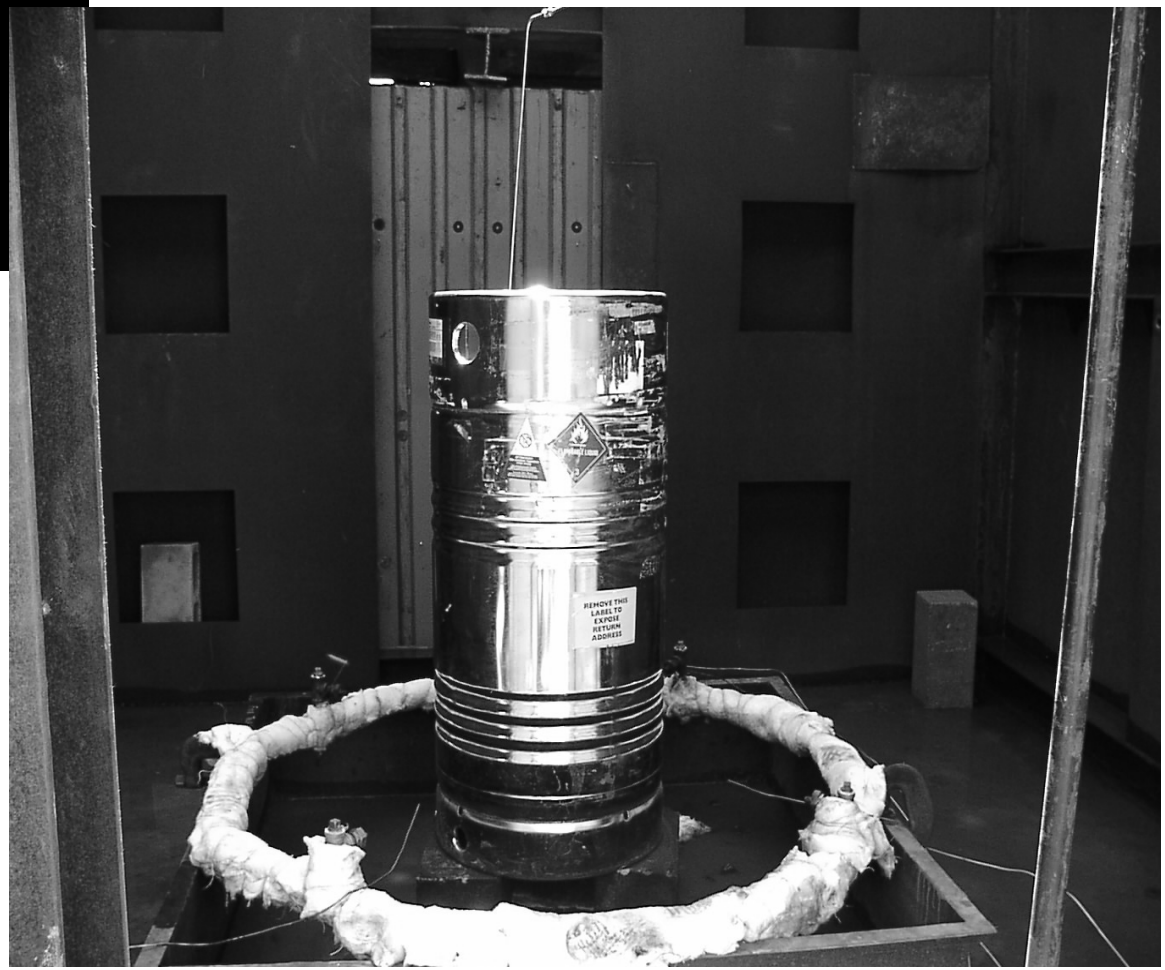
- ests of 200/205-liter containers filled from different manufacturers
- Storage and in-use arrangements tested
- High challenge exposure fire – spray and pool fires with 5 to 10 gallons of heptane
- Test chamber – 15’ X 15’ X 12’ high
- Open head fire sprinklers used for some tests – density was about 0.20 gpm/ft^2
- 2 tests were performed with 4-liter glass bottles for comparison

*Information from Pressurized Liquid Dispensing Containers Research Project – Final Report

Figure B-1. Test 1: Pretest



e B-5. Typical Venting During Test 2

Photo: Copyright The Fire Protection Research Foundation November 2003, used with permission

3. Glass Bottle Control Test in Progress

Photo copyright The Fire Protection Research Foundation November 2003, used with permission

t Results*

- vented without rupturing – No BLEVEs
- PRDs functioned as designed except for Test 7
  - Spring-operated PRDs opened and closed throughout tests
  - Rupture disks “behaved predictably … releasing the internal pressure rapidly”
- In-use dispensing lines can spray fuel to other areas of the room; can whip around if not secured
- Flame projection from open PRD could cause “premature failure of the roof/ceiling”

*Information from Pressurized Liquid Dispensing Containers Research Project – Final Report

Results*

- [illegible]ad "a small impact" on the fuel spray fire
- Sprinklers had "some effect on the PLDC pressure rise", but did not have a significant effect in the overall test
- Sprinklers had little effect on the fire plume especially where the vented gases were directed upwards

*Information from Pressurized Liquid Dispensing Containers Research Project – Final Report

Results*

- Glass Bottle Tests
  - Glass bottles with or without plastic coating will break in the early stages of a fire
  - First test - First bottle ruptured 12 seconds into the fire
  - Both tests – All bottles ruptured before sprinklers would actuate
  - Bottles “broke under the thermal shock of the impinging fire alone”

*Information from Pressurized Liquid Dispensing Containers Research Project – Final Report

de Requirements for PLDCs

- Section 6.2
  - Paragraph 6.2.2 addresses emergency venting requirements
  - Table 6.2.3 – Metal drums, DOT UN 1A1, 450 liter (119 gal.) allowed for all classes of liquids
- NFPA 45 – 2004 edition approved at May 2004 Conference in Salt Lake City – Section 10
  - Table 10.1.4 – Metal container (DOT) – Class 1A – 20 liters (5 gal); all other classes 227 liters (60 gal)
  - Paragraph 10.4.1 – PLDCs listed or labeled by nationally recognized testing laboratory

de Requirements for PLDCs

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- Paragraph 10.4.3 – “Relief devices shall discharge to a safe location, in accordance with manufacturer’s recommendation.”
- Appendix A10.4.3 – “Relief discharge to a laboratory exhaust system may not be appropriate for all sizes of containers for all solvents. Not all lab hoods and exhaust systems are constructed the same and may not be capable of containing or withstanding the vented vapors. Many fume hoods contain ignition sources. The user should evaluate each system based on the use.”

de Requirements for PLDCs

continued

- Paragraph 10.4.4 – “The piping/hose between the container and the use point shall be rated for the pressure, compatible with the materials being transferred and not subject to mechanical damage.”
- Paragraph 10.4.6 – “A readily accessible means to stop the flow of liquid from the container shall be provided.”
- Annex A10.4.6 – Use of dead man valve or remote actuate for liquid dispensing; removal of gas pressure
- Paragraph 10.4.7 – Pressurize with nitrogen or inert gas only

dations for Installation of PLDCs

- Review the allowed quantities of flammable liquids permitted in rooms or fire/control areas under the building code and NFPA 30 & 45; this will limit the number of containers permitted in a laboratory space
- Review FM Global Property Loss Prevention Data Sheet 7-32 on Flammable and Combustible Liquids – section 2.3.1.3 on Inert Gas Transfer
- Use the smallest PLDC possible

dations for Installation of PLDCs

- Locate PLDC outside of the lab if possible or away from other flammable/combustible materials in a lab
- Plumb PRD to an exterior location or other location with capability to handle emergency venting
- Use the lowest pressure possible to transfer the liquid
- Use dead man or point of use actuators to initiate liquid flow

dations for Installation of PLDCs

- nkler system density vs. hazard of PLDC
- Install small PLDCs in safety cabinets with pass through valves
- PLDCs are intended for continuous use processes

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- be safely used in laboratory spaces
- PLDCs can be safer then glass bottles or 5 gallon cans
- PLDC installations require an engineered design and a detailed fire protection review for safe operations

Questions